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Femtosecond coherent spectroscopy of four-wave mixing and photon echoes in a GaAs/AlGaAs heterostructure at room temperature

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Abstract

The results from experiments employing coherent femtosecond spectroscopy in a layer of two-dimensional electron gas at the boundary of the GaAs/AlGaAs heterojunction at room temperature are presented. The decay curves of primary femtosecond photon echo are obtained. The decoherence time in two-dimensional electron gas depends strongly on the power of the exciting pulse and varies from 36 to 54 fs. The dephasing time is studied for the first time as a function of the power of exciting pulses at room temperature. It is established that this dependence obeys the law T 2 ~ N -0.22, which differs from the typical law T 2 ~ N -1 for unscreened electron-electron interaction in semiconductor crystals. Analysis shows that electron-phonon interaction plays an important part along with electron-electron interaction. The induced spin gratings in the GaAs/AlGaAs heterostructure are studied with an eye to their possible application in spintronics. © Allerton Press, Inc., 2012.

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